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*THE BRITISH ASSOCIATION. A RETROSPECT.**

THE third Belfast meeting, in respect of attendance, has been very considerably below the average, the numbers being a little over 1,600, or about 300 less than in the case of the previous meeting, 28 years ago. This falling off is mainly due, we believe, to the fact that the people of the neighborhood did not take an active interest in the meeting by becoming associates to anything like the extent that might have been expected. The number of old life members and old annual members, as well as of new life members and new annual subscribers from a distance, was not below that of the previous Belfast meeting and was up to a fair average. There may be other reasons to account for the diminished attendance. Although the Saturday excursions were numerous and attractive enough, and the garden parties and other receptions of daily recurrence, still there were no official excursions following the meeting. It is to be hoped that these will never be revived. There is no reason to regret the falling off, if it is mainly due to the fact that the attractions to unscientific trippers were fewer than in the past. It is true that the diminished attendance led to the cutting down of the grants for scientific research to an unusually low figure; but, after all, there are nowadays many other ways of obtaining pecuniary support for such purposes. The afternoon receptions especially have a serious effect on the attendance of such sections as meet after lunch. This practice of holding afternoon meetings is likely to spread among the sections, and it is deserving of consideration whether some modification should not be made in what is, after all, no necessary part of the functions of the Association.

At Belfast, as at previous meetings, probably some of the most useful work of the

Association was done outside the section rooms, at the informal gatherings that take place among the working members. A staple subject of discussion at such meetings is that of the functions of the Association in relation to modern conditions so very different from those which existed even half a century ago. The scientific work of the Belfast meeting was certainly up to the average in most of the sections, although in many cases the papers read were of restricted and very special interest. The new section which deals with education, as well as the section of economics, set a good example by arranging beforehand to have only a very few subjects of wide interest on their programs, to be dealt with on the four or five real working days of the meeting, and to be thoroughly discussed by men capable of treating the subjects with knowledge and intelligence. It would be well if the other sections would follow this admirable example. It would give the British Association much more of a *raison d'être* than it has at present, all the more if it could also be arranged that two or more sections should combine for the consideration of important subjects in which they have a common interest. It is also felt that one important object of these meetings should be to bring the younger workers in the different departments of science into personal relations with those who have already made their reputations and who, by a few kindly words of encouragement and guidance, might do much to inspire the younger men with confidence and enthusiasm. At present the younger workers in science, who come from all parts to attend these meetings, as well as those who may be working at serious disadvantage in the locality, may spend the whole week diligently attending the meetings of the sections and never exchange a word with their distinguished seniors. The large receptions that are held during the meet-

* From the London *Times*.

ings are of little avail for this purpose; but there are other and more informal ways which it would not be difficult to devise.

These are some of the topics which were freely discussed at the informal gatherings of the permanent members of the Association, most of them men of distinction in the scientific world. It must be admitted that the chilly and rainy weather which prevailed during most of the week may have had no inconsiderable effect upon the attendance. It must be said, however, that the hospitality of Belfast was thoroughly Irish in its warmth; and, as has been stated, the scientific work of the meeting was quite up to the average, on the lines on which that work is at present conducted. In most of the sections one or two subjects of considerable importance were brought forward for consideration and discussion, although, as we have said, Sections F and L carried off the palm in this direction. The attendance at the Educational Section was always large; the Anthropological Section was often crowded; while the section of geography, although unfortunately located at a considerable distance from the center, had no reason to complain of being neglected. Although the proposal that the meeting of 1905 should be held in Cape Colony was mentioned at the general meeting, the matter was not discussed. The serious consideration of the proposal will no doubt take place next year, when probably the invitation will be brought forward formally. It is to be hoped that nothing in the meantime will occur to place the matter in abeyance.

We shall now give a brief résumé of what may be regarded as the most important results of the meeting. The address of the president, Professor Dewar, will be of permanent value as a history of the efforts which, up to the present, have been made to investigate the effects of extreme low temperatures upon gases.

In a review of the work of Section A (Mathematical and Physical Science), two of the subjects dealt with stand out prominently. Professor Schuster, chairman of the department of astronomy and cosmical physics, called attention to the great waste of power which is taking place in sciences like meteorology, where those working at the subject are devoting their energies almost exclusively to the collection of observations. Those engaged in reducing the observations, and in deducing from them the physical laws which underlie meteorological phenomena, are few. As a result, undigested figures are being accumulated to an extent which threatens to crush future generations. Professor Schuster pointed out that observations taken without a view to the solution of some definite problem were of comparatively little value, and pleaded that a larger proportion of the time at present devoted to the collection of observations should be given up to their discussion. This, he thought, should be done even at the expense of discontinuing observations which, like those of the magnetic elements at Kew, have been carried on for many years without a break. In the discussion of these suggestions that followed, Dr. Shaw, head of the Meteorological Office, pointed out that many of the proposed changes could best be carried out by the establishment in one or more of our universities of professorships of meteorology. Such a course would lead in a few years to the existence of a body of trained meteorologists capable of discussing, from a physical point of view, the observations taken by the organizations at present at work. The other prominent question which has been referred to was brought forward by Lord Rayleigh, who asked, Does motion through the ether cause double refraction of light in transparent bodies? He reviewed the evidence which has led physicists to conclude that the earth in its

motion does not drag the ether along with it. Thus each body on the earth's surface is, in virtue of its motion with the earth, traversed by a stream of ether, and the question arises—Does light travel through such a body with the same speed along the stream of ether as it does against or across it? The experiments of Michelson and Morley lead to an affirmative answer for air; those carried out recently by Lord Rayleigh now enable the same answer to be given in respect of liquids; and it is hoped they will soon decide the question in the case of solids.

In Section B (Chemistry) considerable interest was taken in the discussion of two monographs on hydro-aromatic compounds with single nucleus (Dr. A. W. Crossley) and our present knowledge of aromatic diazo-compounds (Dr. G. F. Morgan). The subject of the first of these contributions derives interest from the fact that hydro-aromatic compounds form a starting-point in the study of the camphors and the constituents of turpentine and many essential oils. The diazo-compounds are important, not only because their study has led to theoretical results of the utmost value in connection with the mechanism of chemical change, but because they are used industrially in the manufacture of most of the coal-tar dyes. The two monographs referred to are to be published at length in the annual report. They constitute very complete résumés of branches of organic chemistry, of which the literature is distributed through many different journals. If for no other reason than this, they will prove of great service to both teachers and students of the two subjects. The paper on the alkylation of sugars, by Professor T. Purdie and Dr. J. C. Irvine, deserves special notice; the method which it described for exchanging hydroxyl hydrogen atoms in the molecules of certain sugars by methyl groups should prove of great value.

Dr. E. F. Armstrong contributed an important paper on the synthetical action of enzymes, in which the formation of a disaccharide by the action of the enzyme lactase on milk sugar was described. The new disaccharide, isolactose, is a true sugar and its synthesis is one of the first steps taken in synthetic work upon disaccharides.

No one of the papers brought before Section C (Geology) was of very great importance; but nearly all were records of valuable work. A paper by Mr. George Barrow, on the prolongation of the Highland border rocks into county Tyrone, gave rise to the best discussion of the meeting. The paper dealt with rocks termed the 'green rocks,' found by the author in the neighborhood of the great fault which crosses Scotland from sea to sea. This line of disturbance has now been traced across Ireland to Clew Bay and Clare Island, and Mr. Barrow believes that he can identify rocks in the neighborhood of Omagh with the 'green rocks' of Scotland. He considers them to be of pre-Cambrian age, and with this conclusion Professor Grenville Cole agrees. Papers of considerable importance were read by Dr. Traquair and Mr. H. Kynaston. The former described some fossil fishes of the lower Devonian roofing-slate of Gmünd, in Germany. They belong to the class with mailed bodies, and the fact that they are there found associated with fossils of a thoroughly marine character shows that these mailed fishes lived in the sea. Mr. Kynaston, who has been mapping the northern part of Argyllshire for the Geological Survey, brought forward satisfactory evidence proving that the sheets of volcanic rocks in the neighborhood of Glencoe and the Black Mount are, like the volcanic series of Lorn, of lower old red sandstone age, and that the great granite mass of Ben Cruachan is of newer date than these volcanic sheets. This was probably the most important paper brought before

the section. The rocks of Eocene age attracted more attention from the members in the field than in the section room. They were dealt with at some length by Professor Grenville Cole in his lecture on the geology of the neighborhood of Belfast, and Mr. Horace B. Woodward contributed a valuable note, describing a section on the new railway between Axminster and Lyme Regis. The Pleistocene and recent periods received a large share of the attention of the section. Mr. Teall, director of the Geological Survey, exhibited a late proof of a new drift map of the Dublin area, which will be the first sheet of the Geological Survey map on the scale of one inch to the mile, printed in colors, instead of, as has hitherto been the custom, colored by hand. It is to be hoped that more of these color-printed sheets will be issued, as they are both cheaper and clearer than the hand-colored maps. The post-glacial deposits of the Belfast districts were dealt with in an interesting paper by Mr. Lloyd Praeger. He described the 'peat bed,' an old land surface now twenty feet below low-water mark at Belfast, but between tide marks at other places. In it the Irish elk has been found.

In Section D (Zoology), as in the other sections, no startling or epoch-making discoveries were brought to light; but most of the papers were quite equal to the average of former years in interest and importance, and were solid contributions to zoological science. In his opening address the president, Professor Howes, traced in a masterly summary the marvelous advances made since the last Belfast meeting in our knowledge of the animal kingdom and in the precision given to our ideas of the inter-relationships of its various groups, thanks to the morphological method. Of great practical importance were the papers by Professor McIntosh and Mr. Garstang on the international scheme for the protection

and increase of the North Sea fisheries. Considerable divergence of opinion existed as regards the over-fishing of certain parts of the North Sea. Professor McIntosh held that it was practically impossible to over-fish; but this is not the view of Mr. Garstang nor of the majority of marine biologists. The committee which is investigating the migration of various British birds this year presented an interesting summary, by Mr. Eagle Clarke, of Edinburgh, of observations on the migrations of the fieldfare and lapwing. This was drawn up in the same masterly manner as his previous reports on the migrations of the song-thrush, white wagtail, skylark and swallow. It is certain that, if we are ever to fathom the mystery of migration, it will be only by the methods employed by Mr. Clarke. The zoological collections obtained by Professor Herdman among the pearl-oyster beds in the Gulf of Manaar were described by various specialists; and in this connection it must be remarked that to the ordinary naturalist it does seem that some restraint is called for in the description of new species, especially among some of our amateur workers. Upon minute differences in characters subject to great variation numbers of unique specimens have been added to an already overburdened literature, many of which can be only individual variations. Professor Poulton's exhibition of a series of the predaceous flies of the family Asilidæ, taken in Spain, was specially interesting. Each was shown with its prey in its grasp. The prey consisted mainly of bees and ants, but extended to bugs and beetles, often several times the size of the assailant. The females, which are larger than the males, apparently also prey upon the males of their own or a nearly related species. Very interesting, too, among several interesting contributions on the subject of mimicry, were Professor Poulton's slides, prepared by the three-

color process, showing the protective resemblance and seasonal forms of butterflies, and the natural attitudes of British insects. There is an undoubted tendency on the part of insects, and also of many other animals, not only to adopt the color tone of their immediate surroundings, but also to imitate the appearance of other insects so as to escape the dangers threatening their own species. Professor Poulton lucidly explained how the phenomena exemplified by the slides can best be interpreted by the theory of natural selection. Professor McBride and Dr. Masterman summarized the results of their investigations, extending over several years, of the development of the starfish. But on several important points the two authors appear to have arrived at opposite conclusions, and further investigation is evidently needed. Professor Ewart continued the interesting contributions he has made to this section on the subject of the inter-crossing of animals, with an account of his experiments on dogs. His main contention was that in the second generation a purer offspring was obtained than in the first; but the general opinion was that this conclusion was scarcely warranted after so limited a number of experiments.

The address of the president, Sir Thomas Holdich, in Section E (Geography) ought to be of great service in this department, insisting as it did on the necessity for the introduction of more scientific methods in geographical work, and especially in the work of exploration, which may now be said to have passed beyond its pioneer stage. Mr. R. B. Buckley, in his paper on 'Colonization and Immigration in British East Africa,' gave an excellent example of the practical uses to which geographical investigation may be put, if only conducted on rigidly scientific lines; while Professor Libbey, in the account which he gave—admirably illustrated as it was by photo-

graphs taken with intelligence and discrimination—of his recent work in the Jordan Valley, showed the instructive results which may be achieved by the scientific method applied to pure geographical investigation. Other examples pointing in the same direction were the papers of Dr. Herbertson on the windings of the Evenlode; Mr. Lloyd Praeger on geographical plant groups in the Irish flora; Mr. Porter on the Cork Valleys; and especially that of Professor Watts on a buried Triassic landscape, Charnwood Forest. Professor Milne's brilliant account of his investigations into world-shaking earthquakes showed the perfection to which his seismological records have attained, and the important discoveries which he has thus been able to make as to the part played by these disturbances in altering, not only the face of the dry land, but also the bed of the ocean. As might have been expected, the subject of Antarctic exploration formed a prominent feature in the meetings of this section. Nothing could have been more admirable than Dr. Mill's exposition of the various stages of our knowledge of the South Polar region and of the actual results of exploration up to the present time; while Mr. Bruce, the leader of the Scottish Antarctic Expedition, had a hearty and thoroughly sympathetic reception when he came forward to explain the objects and equipment of that expedition, which, as distinguished from others now at work in the Antarctic, will be mainly oceanographical. The communication from Sir Clements Markham, with reference to a possible search expedition for Captain Sverdrup, was highly instructive—though, happily, now that Captain Sverdrup has arrived home, no such expedition will be required. Dr. Johnston's account of the Survey of the Scottish Lakes, which is being conducted under the direction of Sir John Murray, showed what a vast amount of ex-

cellent work has been accomplished in considerably less than a year's time.

By regular attendants at Section F (Econometrical Science) the Belfast meeting will be remembered chiefly for its president's address and for the large and attentive audience which followed the papers of local interest. Dr. Cannan in his address struck the keynote of the meeting—the reinforcement of the most elementary economic principles and their immediate application to the complex problems now to the fore in popular discussion. The meeting did not elucidate any important new contributions to economic theory, but appeared to be educative in its character. Again and again professed economists emphasized, apparently to the complete satisfaction of a well-filled room, the teaching of the most orthodox masters in refutation of badly-conceived proposals. It would be untrue to say that Dr. Cannan's simple and conclusive application of the theory of rent to the question of municipal housing and other municipal ventures commanded the immediate and unqualified approval of a section which has been in the habit of debating municipal policy year by year with the accredited representatives of local governing bodies through the length and breadth of the land. When Mr. Porter, on the Friday, condemned unhesitatingly all productive municipal enterprises, speakers from Nottingham and Manchester were in disagreement with his conclusions; but the general audience appeared to be in sympathy with the reader, and the discussion was not sufficiently long or representative to cover the ground adequately. Those who agree with the reader of one of the weakest papers ever presented to the section, that a large body of educated thinkers are weakening on the strict theory of free trade, should have been present on the day devoted to Irish questions. The representatives of Belfast industries were

completely at one with the platform in denying the practicability of an Imperial Zollverein, as emphatically as they ridiculed the proposal for a 'moderate measure of protection for Ireland.' The advantage to the home-country of a differential duty in its favor on the part of a colony was generally admitted; but the question whether such a relaxation was to the real interest of the colony was not discussed. Judge Shaw's paper, which introduced and dominated the discussion, was deservedly applauded; for it put in a simple, accurate, and intelligible form, calculated to appeal to the ordinary educated man, the fallacies and difficulties inherent in current protective proposals. The plan, introduced at former meetings, of allotting a day to those subjects which are of special interest to the locality was continued and expanded. The 'free trade' day began with a valuable historical essay on the linen trade; and, to judge from the local press, this was calculated to be of considerable use to those engaged in the industry, as well as of importance to the statistical historian. A previous morning had been devoted to the consideration of trusts, with particular reference to the shipping combination. Though this excited much local interest, it cannot be said that the audience was really representative, nor that much was added to the theory or the facts in question; but, so far as it went, the tone was optimistic. Belfast does not stand to lose by recent developments; it was expected that the British shipping interest would survive without damage; and, on the more general question, it was held that trusts did not flourish in a free-trade atmosphere, and that, even where their existence could be maintained, prices would not rise nor wages fall; but there was a lamentable absence of reasoned statistical verification. Education was to the fore in Section F, as well as elsewhere; and, in the presence of

teachers from Dublin, Belfast, St. Andrews, Edinburgh, Oxford, Cambridge and London, a discussion as to the possibilities and future of commercial education had to be closed when the luncheon hour was far passed. As is always the case, the few papers which were of definite value for the clearing up of disputed points in theory attracted little attention. Among these were Professor Morison's demonstration that the prices of cereals measured in silver in India had fluctuated at least as much as English gold prices through the nineteenth century, and Professor Chapman's careful analysis of the possibilities and use of sliding scales and other means of regulating wages in relation to profits and of minimizing their fluctuations. There were very few statistical papers. The practical work of the section is for the present concentrated in the investigation, which now enters on its third year, of its committee on the 'Economic Effect of Legislation Regulating Women's Labor.' A long interim report was presented, and two careful papers were contributed on the recent history of administration. It seems probable that the committee will accumulate a large amount of first-hand evidence; and it is so constituted that all phases of opinion are represented. On the whole, the section shows signs of renewed vitality; the platform and the room were generally well-filled, the discussions were well sustained, though not informing, and the communications showed careful and well-reasoned work.

The subjects which occupied most of the time of the Section G (Engineering) were 'education' and 'power.' The president, Professor John Perry, professor of mechanics in the Science School at South Kensington, has actively demanded for some years past that the methods of teaching young engineers should be improved. Mathematics has been the point on which

he has been most urgent; and a committee was appointed, with Professor Forsyth as chairman, on his initiative, to consider how mathematics can be better taught. This year the address from the presidential chair dealt with the subject of an engineer's education more generally, and insisted particularly on the continual use of experiment by the student himself as distinguished from oral lecture or demonstration by the professor. Professor Perry's address was subsequently made the subject of discussion at a joint meeting of the Engineering and Educational sections, under the presidency of Professor Armstrong, in which several well-known scientific men and engineers took part. In a highly suggestive paper in this section Mr. W. Taylor raised the question of what he termed 'the science of the work-shop.' It is the application of scientific knowledge of the properties of matter to work-shop processes, and the examination of the many curious and important problems raised by them. Instruction in this branch of science is necessary for the mechanical engineer and the artisan, in just the same way that mathematics and dynamics are for the civil engineer or the electrician. The questions which have to be dealt with are in many cases minute and abstruse, information on them is scarce, and they do not form part of any generally useful educational subject. It is evident, however, that accurate knowledge on such subjects as the properties of cutting tools, of lubrication, of the thermal treatment of steel, and the numberless other processes carried on in our workshops, too often only by rule of thumb, is of first-rate importance to mechanical industries. In the subject of power important papers were read on gas-engines, on the combustion of coal, and on the standing question of water-tube boilers. Most of the considerations were of a highly technical kind; but two broad facts were clearly brought out—viz.,

the rapid development that is taking place in the use of gas-engines for very large powers, and the advantages possessed by the water-tube boilers over the tank boilers, which justify perseverance in trying to remedy their present defects. The Hon. C. A. Parsons attracted a large audience to hear a paper on the recent progress of the steam turbine. Besides the above subjects, a very able and judicial paper on the difficult question of competition in telephony was contributed by Mr. J. E. Kingsbury, which deserves to be widely read both on account of the author's intimate knowledge of the subject and of the calm temper of his review. He concluded that the telephone service was essentially not a proper field for competition. An account by Professor George Forbes of the practical trials in the South African war of his beautiful range-finder excited great interest.

So far as Anthropology (Section H) is concerned, the Belfast meeting will rank as one of the most efficient for some years past. The average quality of the communications was high, and the tone of the discussions uniformly business-like and judicial. The president's address, which was devoted to the much-debated question of the nature and origin of 'totemistic' observances among uncivilized peoples, certainly contributed much, by its cautious and learned survey of the evidence, to clear a somewhat thorny field; and its suggestion that many if not all of these customs may be primarily related to the all-important subject of the food supply of primitive man will probably be found to have suggested a profitable field of fresh inquiry. With this encouragement from the chair, it is not surprising that the other papers on points of custom and folklore were numerous and of good quality; the most important of them, Mr. Hartland's discussion of the modes of appointment of Kings by augury, being further

made appropriate to the season by its examination of the significance of the Stone of Destiny at Tara and our own Coronation-stone. Archeological papers were numerous. Some of those of local origin were perhaps hardly up to the general level, but gave indication of intelligent and systematic work on the antiquities of the neighborhood. Mr. Abercromby's classification, on the other hand, of the earliest pottery of the Bronze Age in these islands, and Mr. Coffey's identification of objects in Ireland analogous to those of 'Hallstatt' and 'La Tène' style on the continent, were pieces of original research of a high order, and each provoked a well-sustained discussion. The Cretan Report brought up to date the record of Mr. Evans's discoveries at Knossos; and other papers on Mediterranean archeology, though not so numerous as of late, showed that efficient work is being carried on by other students also. The Cretan Exploration Committee was reappointed, with enlarged terms of reference and a fresh grant; and it has instructions to make the examination of the physical type of the ancient and more recent population one of the objects of the forthcoming campaign. The discussions which arose on paleolithic matters, though, as usual, not very conclusive, raised a number of interesting points, and were well illustrated from the collections of Mr. W. J. Knowles and other contributors; and two little reports, on Roman sites at Silchester and at Gellygaer, near Cardiff, showed that the Association regards even 'classical' archeology as lying on the margin of its domain. Papers reporting recent explorations abroad were fewer than usual, South Africa claiming still the majority of the men of adventure. But Mr. Henry's paper on the tribes of the Yun-nan border showed well what opportunities frontier officers have about them, if they will use them; and its description of the new pygmy folks

there offered an instructive parallel even in detail to the legends of the 'little people' in the west of Europe. Messrs. Annandale and Robinson added considerably to the materials collected in the Malay Peninsula by the Skeat expedition of two years ago; and the account which Dr. Furness gave of his work among the Nagas showed well to what extent photography can now be applied in recording these vanishing aborigines. The committees appointed to prosecute research on the sense perception of the Todas and on the surviving languages and peoples of the Pacific illustrate still further the urgent necessity of gathering in such material before it is too late. Human anatomy and physical anthropology were somewhat better represented than in recent years; but it is much to be regretted that this side of the section's work is not better attended on both sides of the table. Professor Cunningham's exhibit of the skeleton of Cornelius MacGrath, the Irish giant, raised an interesting point in the study of abnormal stature, by connecting it with abnormal states of the pituitary body in the brain; and Professor Dixon, who followed him, was able to support his view on independent grounds. The reports of the measurements taken by Dr. Myers of the native troops in Egypt, and by Mr. Gray of the Indian Coronation contingent, showed well how much might easily be done, with very small trouble, with large bodies of individuals accustomed to obey simple instructions. In Egypt, indeed, the Government offered every facility for the investigation; but at Hampton Court, as well as at the Alexandra Palace, the European officers hardly seem to have taken the inquiry seriously, and displayed a regrettable indifference to a matter in which, after all, they are themselves the most nearly concerned. The last session, devoted to questions of classification, organization and method, was well worth imita-

tion elsewhere; and suggests that the anthropologists are becoming well alive to the necessity of coordination and systematic outlook in their work.

Although the meetings of Section I (Physiology) were confined to the forenoons of three days, the proceedings were enlivened by a number of contributions of undoubted physiological value. Professor Halliburton's presidential address, which emphasized the importance of chemical physiology, did not prevent experimental and morphological contributions from receiving their share of attention and criticism. The opening day witnessed a discussion following a paper by Dr. Edridge-Green on color-vision. Dr. Edridge-Green has a theory of his own on this subject which he has brought forward with great persistence and under various titles before physiological circles for some years back. This time he supported his theory by describing some experiments the results of which are at variance with those recorded by previous observers. He was then and there challenged by Professor McKendrick to repeat his experiments before a committee of experts. The challenge was accepted by Dr. Edridge-Green, whose theory has therefore every prospect of being soon put to the test. Professor Schäfer's two contributions were of exceptional value. In one he showed that the epithelial part of the pituitary body, which preponderates over the nervous part and to which no function has hitherto been assigned, in reality elaborates an internal secretion which acts powerfully on the kidney, producing increased urinary flow. In his second communication he added an important chapter to the physiology of those puzzling strands of nerve fibers in the spinal cord known as the anterior columns, assigning to them the maintenance of tone in the muscles, without which volitional movement would be impossible. Equally important, as new

and unlooked-for discoveries, are those cases in which problems long the subject of debate and contention are solved or dismissed. If finality is ever attainable in physiological debates the question of fatigue in nerve has surely reached that stage; for Professor Gotch showed by the results of his ingeniously simple but convincing experiments that functional fatigue does not exist in a medullated nerve. Much the same may be said of the paper by Professor Halliburton and Dr. Mott, in which strong evidence was brought forward in support of the contention that when a divided nerve grows again and heals the growth takes place from that end which is connected with the nerve center. Dr. John Turner's paper on the human brain was both morphological and physiological. Professor Schäfer accepted as accurate the morphological part, but dissented from Dr. Turner's physiological interpretations. It will be seen, even from this succinct sketch, that the Physiological Section enjoyed a successful, if brief, career, and that physiology has been enriched by contributions of importance.

In his presidential address to Section K (Botany) Professor J. R. Green emphasized the study of vegetable physiology, not merely on account of its intrinsic importance in special botanical problems, but as a subject of fundamental economic importance, especially in relation to agriculture. The papers read in this branch of the subject were of considerable interest, one of the most important being that by Professor Bose, who showed by experiments that plant tissues respond to stimulation in much the same way that muscle fiber does. Mrs. D. H. Scott also described the curious movements of the flowers of *Sparmannia* in relation to its environment. Professor Macfadyen described experiments on the exposure of bacteria to intense cold, which demonstrate that their vitality is not de-

stroyed even after an exposure to a temperature of 250° C. below zero. In the department of fossil plants great interest was shown in the papers contributed by Mr. Seward; Miss Benson, D.Sc., and Mr. Lomax; and Dr. Scott submitted observations on Sporangiphores, which indicate that they may afford an important clue to affinities among groups of recent and fossil plants. One of the important papers was that by Professor Oliver and Miss Chick on *Torreya*, which raised many points of morphological importance, especially in connection with the evolution of the seed. Mr. Stirling, in a paper on the flora of the Australian Alps, pointed out that the evidence now available confirms the original forecast of Sir J. D. Hooker, that the affinity between the Antarctic and South African floras indicates them as members of one great vegetation. Some valuable papers on fungi were contributed from the Cambridge botanical laboratory, and Miss Lorrain-Smith read a paper of economic importance on a fungus disease of the gooseberry. Mr. Lloyd Praeger contributed a valuable paper on the composition of the flora of the northeast of Ireland. The arrangements made by the local secretaries were excellent; and interesting excursions to the new fernery at the Botanic Gardens and to Colin Glen were well attended by the botanists present at the meeting.

In the second year of its existence the infant section of the Association—L (Education)—has justified the efforts of those primarily responsible for its appointment by the extraordinary interest that has been evinced in its proceedings. The papers and discussions have reached a high level, and have given a stimulus to educational thought which has already borne valuable fruit and provided many constructive suggestions. The section is naturally exposed to the grave danger of becoming the happy hunting ground of educational faddists.

But the committee have from the first realized this danger, and in order to avoid it have adopted a procedure somewhat different from that of other sections; broad subjects of discussion have been laid down by the committee, and those papers arranged for that form valuable contributions to such discussions. It is thus possible to obtain the succinct opinions of a considerable number of educationists without occupying the time of the meetings with the elaboration of formal papers. On few other platforms can educational problems be discussed from so thoroughly independent and scientific a point of view by men representative of all types of culture and imbued with the spirit of progress. The section should in the future play an important part in directing public opinion towards a solution of the numerous problems of British education. The selection of Professor H. E. Armstrong as president of the section was but a fit and proper recognition, not only of his efforts in establishing the section, but of his persistent and unwearied advocacy of reform in the methods and ideals of English education. In his discourse on 'The Scientific use of the Imagination' he showed in eloquent and forcible language that the long domination of the schools by the classic and the cleric has led to a serious disuse of the imagination in education. Time-honored curricula in the public schools have retained their autocratic influence, in spite of the fact that in the meantime science has revolutionized every sphere of industrial and social activity; he laid down a doctrine of education and an ideal of the function of the school which are far removed from those at present accepted by the great body of schoolmasters.

If there is one paper more than another that will make the Belfast meeting of the Association remembered, it is that of Dr. Starkie, the Resident Commissioner of

national education. Occupying the principal official educational appointment in Ireland, he ruthlessly laid bare the insidious causes that have stunted the development of education in that country. The vast majority of Irish schools are controlled by one manager—the minister of religion of the denomination to which the school is attached—who has absolute power over the appointment and dismissal of the teacher, but who provides no part of the teacher's salary; the department of national education pays the full salary of every teacher, and has no voice whatever in appointing or dismissing him. As there is no local taxation for primary education in Ireland, except for those few schools vested in, and therefore maintained by, the commissioners, there is no satisfactory means of keeping the school buildings in a habitable condition, or of supplying the necessary equipment. The funds the manager can raise seldom stray from the path to the church, and the upkeep of the school is too often chargeable to the underpaid teacher. The courageous attitude of the Resident Commissioner has already profoundly stirred educational thought in Ireland, and, it is to be hoped, has aroused a public opinion on the subject which it is indispensable should be created before an attempt can be made to find a remedy. The partial reforms that have recently been made in intermediate education in Ireland were condemned by Mr. Jones and Father Murphy on account of their incomplete and unsatisfactory character; and the discussion which arose on this subject must have an important influence on future policy. The new Department of Agriculture and Technical Instruction, for which Mr. Plunkett has labored so long and so earnestly, met with almost unqualified approval as to its educational policy.

It will be remembered that Professor Perry's vigorous onslaught upon the mathe-

matical teachers last year resulted in the appointment of a very strong committee to inquire into the matter. The report of this committee and the discussion upon it amply justified Professor Perry's action. Both professor and schoolmaster came forward to advocate reforms in secondary schools suggested in the report; definite constructive proposals have been made as to the curriculum and conduct of examinations; and, though it is obvious that reform cannot stop at this stage, a valuable step in the right direction has been taken. 'The Teaching of English,' which the great public schools, accepting the traditional classical curriculum, have seriously neglected, received considerable attention. Mr. P. J. Hartog, in an able paper, drew attention to the method of teaching style in composition adopted in the principal French schools, and urged that the classical master is wrong in assuming that the only method of teaching English composition and style must be through the medium of Greek and Latin, of which languages the average school boy has not obtained a real grasp. The training of teachers is, undoubtedly, the problem of paramount importance in educational affairs to-day, and the debate on this subject was valuable in directing attention to the shortcomings of existing arrangements for training. Miss Walter's plea for a secondary school career for the future teachers of primary schools is one admitted by every one dealing with primary schools.

SCIENTIFIC BOOKS.

EHRlich's SEITENKETTENTHEORIE.

THE recently published work of Professor Aschoff (Ehrlich's 'Seitenkettentheorie und ihre Anwendung auf die Künstlichen Immunisierungsprozesse') will be of great use to those who desire to keep abreast with the progress of science in this fruitful field of investigation. It is, indeed, an intelligent review of the whole subject of acquired im-

munity, and includes a statement of the principal facts which have been developed by experiment, as well as a discussion of the various theories which have been advanced in explanation of these facts. The great interest attached to the subject and the extent of the field of investigation which has been developed since the epoch-making discovery of the antitoxins of diphtheria and of tetanus by Behring and Kitasato (1890) are shown by the extent of the literature given by Aschoff at the close of his review ('Zusammenfassende Darstellung'). This covers 41 pages and includes nearly 900 titles. Of these Ehrlich has contributed no less than 22. His first paper, published in 1891, demonstrated the remarkable fact that animals can be made immune against certain vegetable poisons (ricin and abrin), and that the blood serum of such animals contains an antitoxin which has a specific action in neutralizing the toxic effects of these poisons, when injected into non-immune and susceptible animals. In prosecuting his investigations Ehrlich has had the advantage over many others who have devoted themselves to similar researches in the fact that he is a most accomplished chemist, and has given special attention to that difficult branch of organic chemistry which is concerned with bodies of the class to which the antitoxins belong.

"In a paper published in 1897 Ehrlich advanced his 'side-chain' theory. He considers the individual cells of the body to be analogous, in a certain sense, to complex organic substances, and that they consist essentially of a central nucleus to which secondary atom-groups having distinct physiological functions are attached by 'side chains'—such as chemists represent in their attempts to illustrate the reactions which occur in the building up or pulling down of complex organic substances. The cell-equilibrium is supposed to be disturbed by injury to any of its physiological atom-groups—as by a toxin—and this disturbance results in an effort at compensatory repair during which plastic material in excess of the amount required is generated and finds its way into the blood. This Ehrlich regards as the antitoxin, which